Deep planting detrimental to longleaf pines on droughty, acid sands

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Longleaf pine seedlings (1-0 stock) planted at conventional root-collar depth in a Florida study were taller, healthier, and more abundant after 5 years than others planted with their terminal buds 1, 2, and 3 inches below the surface of a typical sandhill soil.

How deep should longleaf pine seedlings *(Pinus palustris* Mill.) be planted? Authorities seem to disagree. Mattoon (3) and Wakeley (6). for example. advocated planting at the same depth that seedlings grew in the nursery. but because of the narrow margin for error, preferred to err toward slightly deep rather than shallow planting. Scheer (4) considered shallow planting particularly lethal. In contrast. Coulter (1). Lotti and Shipman (2). and Shipman (5) suggested shallow planting to avoid the possibility of smothering the terminal bud with blowing or silting soil. Adding to this confusion are reports of extremely high survival, early height growth. and low incidence of brown spot needle blight *(Scirrhia acicola* (Dearn.) Singers) associated with sleep planting.

Perhaps we need to reaffirm the longleaf pine planting shibboleth. "don't bury the bud." What better place to test it than in the comparatively well-aerated sandhill soils of the Southeast where longleaf is often planted. Discussion of our study follows.

The Site and Soil

The site selected for the comparison of planting depths was in Calhoun County, Fla. Soil on the intensively prepared site was Lakeland sand with no impediment to internal drainage within 16 feet of the soil surface. The surface 5 inches of soil formed the medium in which terminal buds of interred seedlings had to exist. It was composed of 4.8 percent silt and clay plus 95.2 percent sand. Total pore space averaged 42.9 percent and, because less than 4 percent of the sand fraction was fine sand. presumably was made *up* of many large pores which contribute to a comparatively rapid exchange of moisture and gases.

Rainfall averages about 60 inches annually and about 40 percent of this occurs during June. July. August. and September. Despite its relative abundance, excess water poses no threat to good soil aeration. The available moisture in the surface 5 inches of soil averages only 2.1 percent on an ovendry weight basis. Air temperature seldom reaches 100° F during a 265-day growing season. but soil surface temperatures sometimes exceed 160° F during summer on denuded soils such as those of the test area.

Methods

Longleaf pine seedlings (1-0 stock) were hand-planted at conventional rout-collar depth and deep enough that their terminal buds were covered with 1, 2. or 3 inches of soil. Seedlings for each of the four planting depths were set 3 feet apart in square plots of 49. Plots were arranged in a completely randomized design with four replications. Periodic measurements were made of survival. height. and incidence of obvious seedling infection with brown spot needle blight. Appropriate statistical analyses were used to test and compare the effects of deep planting.

Results and Discussion

Each increase in planting depth resulted in a corresponding increase in mortality. At plantation age 5. this amounted to a 5- to 10-percent decline in survival rate for each inch of soil that covered the terminal bud. The ultimate survival pattern was disguised by early data, however.

Survival rates of seedlings planted at all depths dropped rapidly for the first few years after planting (fig. 1). At the end of the first year, survival

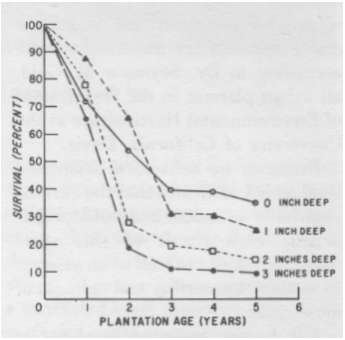

Figure 1.-Effect of planting depth on survival of longleaf pines on a prepared sandhill site in northwest Florida.

of seedlings planted 1 and 2 inches deep was higher than those planted at root-collar (0-inch) depth. Not until age 3 did survival of the 1 inch deep planting drop below that of the conventional. 0-inch planting. Possibly. seedlings planted 1 and 2 inches deep received an initial advantage by being sheltered from the desiccating effects *of suit and wind. The ultimate decline* in survival of deeply set seedlings might well have been the delayed mortality associated with deep planted longleaf pine observed by Wakeley.

Deep planting also had an adverse effect on growth of surviving seedlings (fig. 2). Those planted with their terminal buds below the surface of the soil grew significantly less than seedlings planted at root-collar depth. By age 5, the difference amounted to more than .5 foot. Seedlings planted 3 inches deep made no growth at all (fig. 3). Brown spot needle blight, was not entirely to blame: virtually every seedling was infected. Deep planting afforded no protection against the disease.

Conclusion

Deep planting offers no advantage for reforesting the sandhills with longleaf pine. Increased early survival sometimes associated with deep planted seedlings is transient, even in comparatively well-aerated sands. The highest survival, greatest growth, and lowest incidence of brown spot needle blight was obtained with longleaf pine seedlings planted at the conventional root-collar depth.

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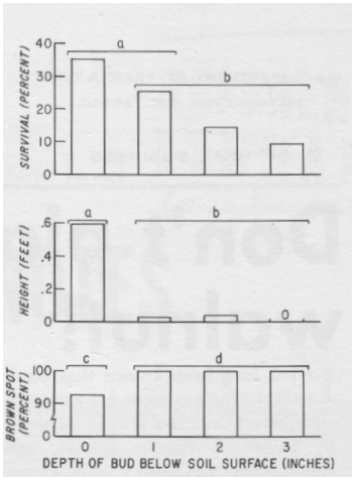

Figure 2.-Fifth-sear survival. height. and brown spot needle blight of longleaf pines planted at four depths on a cleared sandhill site.
Note: Histograms bracketed with an "a" differ from those with a "b" at the 1-percent level of significance: "c" and "d" differ at the 5-percent level.

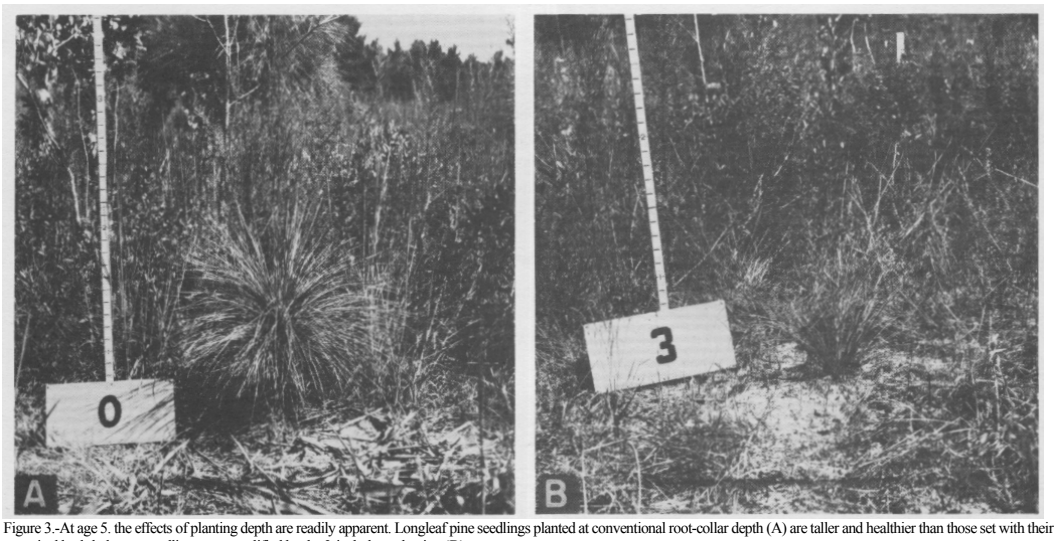

Figure 3.-At age 5. the effects of planting depth are readily apparent. Longleaf pine seedlings planted at conventional root-collar depth (A) are taller and healthier than those set with their terminal buds below groundline, as exemplified by the 3-inch deep planting (B).